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THE DEVELOPMENT OF THE METHOD OF RATINGS FORMATION OF SCIENTIFIC AND SCIENTIFIC-PEDAGOGICAL STAFF PUBLICATION ACTIVITY

Обґрунтовано необхідність формування рейтингів публікаційної активності наукових та науково-педагогічних працівників вищих навчальних закладів як дієвих інструментів забезпечення та підвищення конкурентоспроможності ВНЗ. Розвинуто метод формування рейтингу публікаційної активності наукових та науково-педагогічних працівників за показником, який розраховується як середньозважена кількість наукових публікацій (монографій, статей, матеріалів конференцій) за визначений період. Розроблено заходи щодо посилення публікаційної активності.

Ключові слова: рейтинг публікаційної активності, методика формування рейтингу публікаційної активності наукових та науково-педагогічних працівників, мотивування наукових та науково-педагогічних працівників.

1. Introduction

Publication activity is one of the most important indicators of the effectiveness of scientific and scientific-pedagogical staff of higher educational institutions (HEI), and in general domestic science. According to the Law «On scientific and scientific and technical activities» [1] «the scientific result is a new scientific knowledge obtained in the process of fundamental or applied scientific research and recorded on media. The scientific result can be in the form of a report, a published scientific article, a scientific report, a scientific report on research work, a monographic study ... and so on». The number of scientific publications and their citations are key in the methods for calculating the authoritative international rankings – THE World University Rankings, QS World University Rankings. Therefore, the strengthening of the publication activity is an important activity of the universities in order to intensify the scientific work, obtain the results of fundamental and applied research of a high level, improve the scientific reputation of universities and ensure their presence and promote the improvement of positions in international and domestic rankings.

2. The object of research and its technological audit

The object of research is the method of rating the publication activity of scientific and scientific-pedagogical staff of higher educational institutions. The subject of evaluation of the publication activity of scientific and scientific-pedagogical staff is the number of scientific publications – monographs, articles and conference proceedings.

3. The aim and objectives of research

The aim of research is development of mechanisms and tools for strengthening the publication activity of

scientific and scientific-pedagogical staff of higher educational institutions.

To achieve this goal, the following main tasks are identified:

1. To analyze the state of the publication activity of domestic universities and establish links with the systems of motivation in these universities.
2. To justify the necessity of rating the publication activity.
3. To substantiate indicators for the formation of a methodology for rating the publication activity of scientific and scientific and pedagogical staff.
4. To develop a method for the formation of the rating of the publication activity of the scientific and scientific and pedagogical staff (SSPS).
5. To formulate the proposals for strengthening the SSPS publication activity.

4. Research of existing solutions of the problem

The publication of foreign and domestic scientists, as well as analysts in the field of scientometry, is devoted to the study of various aspects of publication activity [2–8]. In [2–4], theoretical and practical aspects of the use of scientometry are reflected, the development of the methodological foundations of scientometry in the context of expert evaluation of the effectiveness of research activity is analyzed and tools for supporting scientometric studies are developed.

It is important to note that today there is no common opinion on the objectivity of existing approaches to assess the results of scientific activity. For example, in [5] it is pointed out that the simplified approach to assessing the results of a scientist's work is inadmissible; the author argues reasonably that the number of citations, as well as the number of publications in prestigious scientific journals, in fact do not always reflect the absolute

quality of the study. The authors of [6] note that although the number of views of the full-text version of the article and the number of citations can be assessed by the interest of scientists, but this does not take into account many aspects, in particular, quality, novelty and value of publication, and therefore knowledge needs to be assessed not only by quantitative indicators.

The general conclusion is the conclusion formulated in [7]: «only professional expertise can provide a comprehensive objective assessment of scientific results and merits; scientometric indicators as a tool for supporting decision-making by experts». An integrated approach and the combination of expert judgment with scientometric methods of analysis is the optimal solution to the problem of assessing the results of scientific activity.

Therefore, taking into account that the domestic universities set the task of integration into the global scientific and educational space and presence in international rankings, the actual issue remains to search for effective mechanisms and tools for strengthening the publication activity and increasing citations.

5. Methods of research

To solve the problems, the methods of analysis and synthesis, logical generalization, comparative comparison are used.

6. Research results

Publication activity is an indicator of the SSPS effectiveness and its stimulation is a component of the state policy in the sphere of educational and scientific activity. A certain number of scientific publications is one of the requirements for the publication of scientific research results in the certification of workers for academic degrees and academic ranks. Thus, according to [8], for the defense of the thesis for the academic degree of a doctor and candidate of sciences, articles in professional publications of Ukraine and other countries are necessary (publications in Ukrainian journals included in international scientometric databases can be equated to such publications).

According to [9], among the main criteria for assessing the scientific activities of applicants for academic ranks of professors and associate professors is the availability of scientific papers published after the defense of the thesis (respectively, the doctoral and candidate) in domestic and/or foreign peer-reviewed professional journals, of which at least two (one for the academic title of associate professor) of publications in periodicals included in the scientometric databases Scopus or Web of Science. In addition, it is necessary – in the absence of a certificate in accordance with the Pan-European Recommendation on Language Education at a level no lower than B2 – that there are at least 10 papers published in English in periodicals included in the scientometric databases Scopus or Web of Science.

Publication activity is an important indicator of the effectiveness of management policy at the university level. The analysis of the results of the rating of universities in Ukraine according to SciVerse Scopus scientometric database in 2017, which reflects the integral data on the number of publications [10] and monitoring of events, is regularly used by leading universities (Table 1) to strengthen the publication activity, indicates the availability in these universities of integrated systems motivation: the imple-

mentation of the Regulations on the SSPS awarding, on the rating of departments and scientific and pedagogical staff, and the like.

Table 1

The list of universities that took the first ten places in the ranking of universities in Ukraine According to the scientometric SciVerse Scopus database in 2017

No.	University	Number of publications	Number of citations	Hirsch index (H-index)
1	Taras Shevchenko National University of Kyiv	14802	68483	79
2	V. N. Karazin Kharkiv National University	8382	40675	60
3	Yuriy Fedkovich Chernivtsi National University	2547	10122	51
4	Ivan Franko National University of Lviv	5823	28547	50
5	Odessa I. I. Mechnikov National University	2780	14029	50
6	NTUU «Kyiv Polytechnic Institute named after Igor Sikorsky»	5862	13118	43
7	M. Gorky Donetsk National Medical University	953	6056	40
8	Oles Honchar Dnipro National University	3184	10249	37
9	National Technical University «Kharkiv Polytechnic Institute»	2425	8556	36
10	Lviv Polytechnic National University	4278	9025	33

A more detailed analysis of the systems of motivation shows the effectiveness of their influence in a relatively short period of time; Starting from 2010–2013, at the Taras Shevchenko National University of Kyiv, V. N. Karazin Kharkiv National University, Lviv Polytechnic National University, NTUU «Kyiv Polytechnic Institute named after Igor Sikorsky», Sumy State University and other higher educational institutions, led to the ranking «redistribution» of these universities in accordance with analysis of the number of their citations in 2014–2016 in Scopus, conducted by the Center for Social Communication of Vernadsky National Library of Ukraine [11].

Table 2 provides information on the publication activity and the number of publications cited by Scopus in ten universities of Ukraine, sorted by the number of publications in 2016.

Improvement of the ranking positions of the Lviv Polytechnic National University (the third place among universities by the number of publications in 2016) indicates the effectiveness of the motivational policy in this university. In Lviv Polytechnic, a number of Regulations have been developed and implemented, directly and indirectly aimed at strengthening the publication activity. This is, in particular, the Provision on the material encouragement of scientific and pedagogical, pedagogical, scientific and engineering staff and doctoral students of the Lviv Polytechnic National University, which provides for a number of incentives for:

- publication of scientific articles in scientific periodicals that are part of the international scientometric databases Scopus, Web of Science;

- the achievement of the value of the h-index in the scientometric databases Scopus, Web of Science, equal to 10 and above;
- the inclusion of a scientific journal to scientometric databases Scopus, Web of Science;
- publication of English-language scientific journals;
- obtaining international language certificates (from English, German, French);
- obtaining international scientific grants and also the Regulations on the rating of the departments and on the rating of scientific and pedagogical staff.

The leadership by the Taras Shevchenko National University of Kyiv in the rankings of publication activity for a long time can be explained, besides other important factors realized at this university, by the formation of ratings of the publication activity of scientific and scientific-pedagogical staff. Taras Shevchenko National University of Kyiv is now the only university that monitors the publication activity and publishes on its website the ratings of scientific and scientific-pedagogical staff, academic departments (institutes, departments) and scientific departments [12]. Such ratings are published on the site since 2012.

The choice of the Hirsch index (based on the number of scientific publications in the journals included in the Scopus and the number of citations) as an indicator by which the rating is formed due to its use in rating methods by the authoritative international university rankings – THE World University Rankings, QS World University Rankings, as well as when making decisions in competitions for international scientific grants.

The effectiveness of this approach confirms the appropriateness of disseminating positive experience and its use in the motivation systems of other universities. However, it should be noted that the Hirsch index is an important but not the only indicator that should be taken into account when assessing the SSPS performance. The number and different types of publications – in particular, monographs, articles in professional editions of Ukraine and foreign publications, as well as conference proceedings, are taken into account in the methodology for calculating national rankings, when assessing the results of scientific activity of the university by the Ministry of Education and Science of Ukraine, during the examination in competi-

tive selection scientific projects of fundamental research, applied research, scientific and technical (experimental) developments, as well as in evaluating the results of their implementation.

That is why the authors propose to supplement the existing methods of assessing the SSPS publication activity by the method of rating the publication activity on the basis of the indicator, which is calculated as the average number of scientific publications for a certain period.

Let's consider a method of formation of SSPS rating on the index of the publication activity of Ira. It is proposed to form every six months and annual ratings on the index of public activity I_{pa} – an indicator that is calculated as a weighted-average number of scientific publications (monographs, articles, conference proceedings) for a certain period. When creating ratings, authors' profiles (Author ID in Scopus and Researcher ID in the Web of Science) are taken into account, which testify to the author's affiliation with universities.

The rating is formed based on the monitoring results of the number of published monographs, articles, conference proceedings for a certain period (half year or year) contributed by the staff of the departments and scientific units in Science LP.

Science LP is an automated system of scientific reporting developed and implemented at the Lviv Polytechnic National University with the aim of creating a database on the annual results of scientific activities and, in particular, information on the SSPS publications.

Formation of SSPS rating is carried out by building the rating list of employees (according to the institutes, departments, scientific subdivisions) by the index of the publication activity of the I_{pa} – integral characteristic, which aggregates the indices of publication activity by types of publications (monographs, articles, conference proceedings) I_j , taking into account their weight. The form of the rating list is presented in Table 3.

Indices of publication activity by types of publications I_j are integral in subsystems of individualized indicators taking into account their weight. Types of publications (monographs, articles, conference proceedings) are characterized by the corresponding weight coefficients (w_j) (Table 4).

Table 2

Data on the publication activity and the number of citations of universities in Ukraine

No.	University	2014		2015		2016	
		Publications	Citations (2014–2016)	Publications	Citations (2015–2016)	Publications	Citations
1	Taras Shevchenko National University of Kyiv	941	2572	1008	1432	732	201
2	V. N. Karazin Kharkiv National University	451	1020	477	499	405	86
3	Lviv Polytechnic National University	245	434	382	283	376	50
4	NTUU «Kyiv Polytechnic Institute named after Igor Sikorsky»	4229	499	359	211	315	36
5	Ivan Franko National University of Lviv	323	567	314	320	249	36
6	Sumy National University	224	387	204	190	158	46
7	National Technical University «Kharkiv Polytechnic Institute»	147	279	156	127	143	30
8	Yuriy Fedkovich Chernivtsi National University	161	368	155	125	118	22
9	National Aviation University	134	148	143	17	98	12
10	Oles Honchar Dnipro National University	161	170	133	96	95	18

Table 3

The form of the rating of full-time scientific and scientific-pedagogical staff by the index of publication activity in ____ half of ____ year (in ____ year)

No.	Author	Institute	Department	SRL code	SRW code	Post	Academic degree	Number of publications in ____ half of ____ year (in ____ year)															Index of publication activity in ____ half of ____ year (in ____ year)		
9	10	11	12	13	14	15	16	17	18	18	20	21	22	Monographs			Articles			Conference proceedings					
														Published on the decision of the Academic Council of the University, or issued in the languages of the EU (except for English)	Published in English	Other	Total, incl.:	In the journals included in the scientometric databases Scopus and Web of Science	In the journals included in the List of professional editions of Ukraine	In foreign scientific journals	Other	Total, incl.:	Conference proceedings published in the journals included in the scientometric databases Scopus	Conference proceedings (abroad), published in other journals (which are not included in the scientometric databases)	Conference proceedings (in Ukraine), published in other journals (which are not included in the scientometric databases)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	18	20	21	22	23			

Table 4

Indicators for the formation of the Index of publication activity

Type of publication and weight ratio of the type of publication	Sub-type of the publication	The weight coefficient of the sub-type of the publication q_{ji}
Monographs ($W_1=0.4$)	1.1. Monographs published by the decision of the academic council of the university or issued in the languages of the EU (except English)	$q_{11}=0.4$
	1.2. Monographs published in English	$q_{12}=0.5$
	1.3. Other	$q_{13}=0.1$
Articles ($W_2=0.4$)	2.1. Articles in journals included in the scientometric databases Scopus and Web of Science	$q_{21}=0.4$
	2.2. Articles in the journals included in the List of professional editions of Ukraine	$q_{22}=0.3$
	2.3. Articles in foreign scientific journals	$q_{23}=0.25$
	2.4. Other	$q_{24}=0.05$
Conference proceedings ($W_3=0.2$)	3.1. Conference proceedings published in the journals included in the scientometric databases Scopus	$q_{31}=0.7$
	3.2. Conference proceedings, published in other journals (which are not included in the scientometric databases)	–
	3.1.1. Abroad	$q_{32}=0.2$
	3.2.2. In Ukraine	$q_{33}=0.1$

Each j -th kind of publications is characterized by some number of m_j subspecies of publications, which, in turn, are determined taking into account the corresponding weight coefficients (q_{ji}) (Table 4). The weighting factors for the types of publications (w_j) and the weighting coefficients of the subspecies of publications (q_{ji}) are determined on the basis of expert judgment in accordance

with the goals and objectives of the activities of the «Lviv Polytechnic» National University. Coefficients of weight may vary – depending on the objectives and objectives of other universities.

For the formation of the rating list at the first stage, the relative indicators for each type of publications (P) for each person are determined – P_{ji} , where, $j=1,3$, $i=1,m$.

Generalizing characteristics by types of publications is the indexes of publication activity by types of publications I_j , where $j=1,3$, determined in the second stage.

To determine the indices I_j , the P_{ji} indices are calculated for each publication within each subspecies according to the types of publications, taking into account the number of authors N

$$P_{ji} = \sum_{z=1}^{n_j} \frac{1}{N_z}, \quad (1)$$

where P_{ji} – the calculated value of the subspecific index of the employee's publications within each species; N_z – the number of authors, z – the number of subspecies publications.

Index of publication activity by types of publications (monographs, articles, conference proceedings) I_j is the sum of indicators within each type of publications, taking into account their weight coefficients, so:

$$I_j = \sum_{i=1}^{m_j} P_{ji} \times q_{ji}. \quad (2)$$

The third stage determines the integral rating index of the SSPS publication activity (I_{pa}):

$$I_{pa} = \sum_{j=1}^3 I_j \times w_j, \quad (3)$$

where w_j – the weight coefficient of the j -th type of publications (Table 4).

The next stage is the formation of the SSPS rating by the integral rating index of the publication activity.

Formation of ratings of publication activity and publication of them on the university's website is an important motivating factor for SSPS to continue its active work, increase professional qualifications and maintain a constant activity in scientific activities.

The ratings of the publication activity enable the heads of scientific and educational and scientific departments to perform a comparative analysis of activities and assess the contribution of each employee to the effectiveness of the unit and the university as a whole, to use the obtained information for making managerial decisions.

7. SWOT analysis of research results

Strengths. The strength in this research is improvement of the systems of motivation of universities and to promote the strengthening of the SSPS publication activity.

Weaknesses. The weakness of this research is the lack of an opportunity to assess the quality of publications.

Opportunities. The opportunities for further research are the study and analysis of the dynamics of the influence of the ratings of publication activity on the scientometric indicators of universities.

Threats. The threat to the results of the conducted research is the dependence of an objective evaluation of the publication activity on the correctness of the formation of databases of SSPS publications.

8. Conclusions

The indicators of publication activity and citation indexes are not the only and final criteria for assessing scientific results. At the same time, the strengthening of the SSPS publication activity and the increase in citation indexes is an important direction of the university's management policy, since these indicators are used in the calculation methods according to the versions of authoritative international university rankings and in the methodology for calculating domestic rankings, and also during the examination of projects for international grants and when assessing the results of scientific activity of the university by the Ministry of Education and Science of Ukraine, etc.

As a result of the research:

1. It is established that the state of the SSPS publication activity depends on the effectiveness of the motivation systems implemented in the university. The development of a set of measures to encourage employees to engage in scientific activities contributes to the strengthening of the publication activity. The effectiveness of the motivation systems is shown on the example of the Taras Shevchenko National University of Kyiv and the Lviv Polytechnic National University.

2. It is proved that the regular formation and publication of ratings of publications activity has a motivating effect and makes it possible to assess the contribution of each employee to the development of the university, to encourage it to achieve results and maintain a constant activity in scientific activity.

3. The method of rating the SSPS publication activity is developed according to the indicator, which is calculated as the average number of scientific publications (monographs, articles, conference proceedings) for a certain period.

4. Proposals for strengthening the SSPS publication activity are formulated:

- improvement of information support for scientific activities;
- realization of constant monitoring of the performance of scientific and pedagogical workers, fulfillment of their individual work plans;
- improvement of SSPS motivation systems based on monitoring of publication activity;
- improvement of the material and technical support of scientific activities;
- introduction of the practice of compulsory learning of foreign languages; granting the possibility of attending such courses on preferential terms in the linguistic centers of universities;
- realization of constant monitoring of the quality of scientific journals published in universities, and their inclusion into scientometric databases Scopus and Web of Science;
- strengthening of international scientific cooperation.

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РАЗВИТИЕ МЕТОДА ФОРМИРОВАНИЯ РЕЙТИНГА ПУБЛИКАЦИОННОЙ АКТИВНОСТИ НАУЧНЫХ И НАУЧНО-ПЕДАГОГИЧЕСКИХ РАБОТНИКОВ

Обоснована необходимость формирования рейтингов публикационной активности научных и научно-педагогических работников высших учебных заведений как действенных инструментов обеспечения и повышения конкурентоспособности ВУЗов. Развита метод формирования рейтинга публикационной активности научных и научно-педагогических работников по показателю, который рассчитывается как средневзвешенное количество научных публикаций (монографий, статей, мате-

риалов конференций) за определенный период. Разработаны мероприятия по усилению публикационной активности.

Ключевые слова: рейтинг публикационной активности, формирование рейтингов научных и научно-педагогических работников, мотивация научных и научно-педагогических работников.

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FORMATION OF BLOCKS OF CATEGORIAL APPARATUS OF CONSTRUCTION INDUSTRY

Проаналізовано зарубіжний досвід з питань розвитку будівельної галузі. Класифіковані існуючі підходи до поняття будівельна галузь. Запропоновано розглядати будівельну галузь як детенсивну економічну систему в будівництві, що об'єднує діяльність сукупності підприємств і виробництв, що володіють ознакою ресурсного єдності. Сформовано блоки категоріального апарату, що включають промисловий, галузевий, управлінський і соціальний підходи.

Ключові слова: будівельна галузь, будівельний комплекс, будівельні організації, будівництво, блоки.

1. Introduction

Construction industry occupies a leading position in the structure of the national economy of the country and in the development of the territory. At the present stage, the construction industry is a complex system that includes many subsystems that are interconnected and exert mutual influence on the constituent elements. That is why the task of justifying the theoretical and conceptual foundations of the management of the construction industry is urgent in the context of accelerating the structural changes in the national economy, which is expedient to begin with the development of the conceptual apparatus.

2. The object of research and its technological audit

The object of research is the systematization of scientific views of foreign scientists on the development of the construction industry.

The construction industry occupies a leading position in the structure of the national economy of the country and in the development of the territory. At the present stage, the construction industry is a complex system that includes many subsystems that are interconnected and exert mutual influence on the constituent elements. That is why

the task of justifying the theoretical and conceptual foundations of the management of the construction industry is complex, in the context of accelerating the structural changes in the national economy, which is expedient to begin with the development of the conceptual apparatus.

Despite the significant contribution to development of scientific thought in construction, most authors consider the construction industry without paying sufficient attention to modern terminology, the development of which occurs in connection with the evolution of the theory of economics, the improvement of market relations, and the formation of new trends in development of the economy. In the modern scientific and methodological literature, researchers interpret the concept of the construction industry depending on the object and the subject of research. At the same time, it becomes necessary to clarify the conceptual apparatus in the sphere of economic activity, which takes into account various properties and characteristics, as noted in [1].

3. The aim and objectives of research

The aim of the article is formation of blocks of the categorial apparatus of the construction industry to determine the strategic guidelines for the development of construction.